REMARKS

This application has been reviewed in light of the Office Action dated April 23, 2004.

Claims 1-20 are pending in the present application. Claims 1, 7 and 13 are independent. Claims 3, 4, 8 and 14 have been amended to clarify that the thickness of the light transmission region is less than about 5 micrometers (see, for example, original claims 10 and 12, and page 8, lines 27-28).

Claims 1, 3, 5, 6, and 9-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takase et al. (US 5,276,600) in view of Zhao et al. (US 6,382,816 B1).

Claims 1, 3, 5, 6, and 9-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takase et al. (US 5,276,600).

Claims 2, 4, 7, and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takase et al. (US 5,276,600) in view of Zhao et al. (US 6,382,816 B1), and further in view of Deloy (US 6,336,728 B1).

Claim 20 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Takase et al. (US 5,276,600) in view of Zhao et al. (US 6,382,816 B1) and further in view of Simpson (US 6,399,228 B1).

The applicants respectfully request reconsideration, for the following reasons.

The present invention is directed to, among other things, a liquid crystal display device, a side backlight unit, and a lamp reflector for use in a side backlight unit of a liquid crystal display, wherein the liquid crystal display includes a light guide plate including an incident surface and an emitting surface. The light guide plate is provided along the backside of the liquid crystal display panel wherein the emitting surface of said light guide plate faces toward the backside of the liquid crystal display panel. A lamp is disposed along the incident surface of the light guide plate, and is configured with a lamp reflector having an inner circumference surface defining a space for accommodating the lamp, and a light reflection layer is formed on the inner circumference surface. In a key aspect of the present invention, the lamp reflector further includes an arm portion disposed along the emitting surface of the light guide plate at the incident surface side of the light guide plate so that a light transmission region is defined between the arm portion and the emitting surface, and the light transmission

region has a thickness sufficiently small so that periodic bright lines on the liquid crystal display panel are at an inconspicuous intensity level. Support for this is found throughout the specification, for example at lines 15-17, page 18; lines 25-28, page 8; and lines 20-29, page 19. In particular, applicants have observed that by controlling the thickness of the light transmission region, the generation of periodic bright lines can be reduced or prevented (lines 15, page 18 continuing through line19, page 19 and FIGs. 6 and 7). As discussed at lines 20-24, page 19, the light transmission region between the arms of the reflector body and the light guide plate may be occupied by a transparent layer or other layers capable of light transmission. The present invention is applicable both to light transmission regions between an upper or a lower arm and the guide plate (lines 25-29, page 19).

To summarize, among other things, the invention includes a lamp reflector that has a light transmission region between an arm portion of the reflector and the emitting surface of the guide plate. This light transmission region must be sufficiently small to reduce the intensity of periodic bright lines to an inconspicuous level, for example, by making the region less than 5 micrometers thick. The light transmission region may comprise a transparent protective layer, for example comprising a metal-series compound and a resin.

As understood, Takase et al. (US 5,276,600) discloses a curved reflector having a reflecting film 4, which includes a flexible substrate 5 and a high reflectance layer 6, which can be used as a lamp house for a lamp which can be employed as a backlight for a liquid-crystal display panel (col. 1, lines 11-16) that may include a light guide plate 9 (col. 3, lines 39-52, and FIG. 4 and FIG. 5). Takase et al. further discloses, separately, a transparent protective layer provided with the substrate on the side opposite to the high reflection layer (col. 4, lines 63-68).

The Office Action alleges that Takase et al. discloses a flexible substrate (5) that is actually the transparent protective film, referencing FIG. 5. Applicants respectfully disagree with that interpretation. In particular, Takase et al. states "the substrate can be provided with a transparent protective layer on the side opposite to the high reflection layer." (Col. 4, lines 63-65). Thus, Takase et al. makes a clear distinction between the flexible substrate 5 and a transparent protective layer (which is not illustrated in the figures of Takase et al.).

Furthermore, Takase et al. fails to teach or suggest the presence of a light transmission region defined between an arm portion of the light reflector and the light guide plate. In particular, referring to FIG. 5 of Takase et al., the reflector 1 includes a reflecting film 4 including a high reflectance layer 6 and a flexible substrate 5 (see FIG. 3) disposed on the inside of a base 8, which has arm portions disposed along surfaces of a guide plate 9 (FIG. 5). In particular, the coating film 4 (which includes the high reflectance layer 6 and the flexible substrate 5 of FIG. 3) does not extend along the surface the arm portions of the base 8 and between the arms and the guide plate 9.

Zhao et al. (US 6,382,816) is understood to disclose a reflector lamp with a parabolic shaped housing with an interior surface coated with a layer of silver and a protective silica oxide layer disposed thereon. However, Zhao et al. fails to teach or suggest, among other things, a light transmission region between an arm of a reflector body and a light guide plate having a thickness sufficiently small so that periodic bright lines on the liquid crystal display are at an inconspicuous intensity level. Therefore, there is no motivation or suggestion in Takase et al. and Zhao et al. to combine their teachings to arrive at the present invention.

As understood, Deloy (US 6,336,728) discloses a luminaire for back lighting a flat panel display, including a lamp chassis 105 that supports a serpentine lamp 110, and a light guide 115 that has a planar section 310 and multiple protruding sections 320 adapted to fit between adjacent sections of lamp 110 and edges of flat panel display 110 (col. 2, lines 30-37). Light guide 115 enhances the luminance uniformity by capturing light at the lamp, through total internal reflection within light guide 115, and directing it forward over front surface 311 of the light guide (col. 4, lines 19-22, and FIG. 3B). The Office Action cites leg portions of Deloy. However, as understood, the leg portions of Deloy are portions of the light guide 115. By contrast, the arm portions of present invention relate to the lamp reflector. Thus, Deloy fails to teach or suggest a side backlight unit in which a light transmission region is defined between arms of the lamp reflector and the guide light plate, having a thickness that is sufficiently small so that periodic bright lines are inconspicuous on the display. Therefore, there is no motivation or suggestion in Takase et al., Zhao et al. or Deloy to combine the teachings of those reference to arrive at the present invention.

As understood, Simpson (US 6,399,228) discloses a multi layer interference coating comprising at least one multi layer stack deposited on a reflective layer. However, Simpson fails to teach or suggest a light transmission region between arms of a reflective body and a light guide plate that has a thickness sufficiently small so that periodic bright lines are inconspicuous on a liquid crystal display. Thus, Simpson fails to overcome the deficiencies of Takase et al., Zhao et al., or Deloy, as discussed above, and there is no motivation or suggestion in Takase et al., Zhao et al., Deloy or Simpson to combine the teachings of these references, and do not render obvious the invention of claims 1, 7 and 13.

As to the thickness of the light transmission region, the Office Action cites the statement in Takase et al. with respect to the flexible substrate, "the thinner the better in view of the cost reduction of the resulting reflector or the productivity upon formation of a reflection layer." (Col. 4, lines 14-17) However, Takase et al. goes on to state that from "the standpoint of the winding readiness (handling) upon formation of a reflection layer, the thicker the better." (Col. 4, lines 17-19) These two statements cannot be read independently, thus Takase et al. concludes that the preferred thickness is "at least 5 μm, more preferably 25 μm or greater but desirably not greater than 250 μm." (Col. 4, lines 19-22). Thus, not only does Takase et al. fail to teach or suggest a light transmission region between an arm portion and the surface of the light guide plate, as discussed above, Takase et al. also fails to teach a thickness for the flexible substrate less than 5 micrometers, but instead teaches that the flexible substrate must be in a range that is not too thick (not greater than 250 μm) and not too thin (at least 5 μm), and thus the teaching of Takase et al. at col. 4, lines 14-22 is not relevant to the claims of the present invention.

Applicants submit that independent claims 1, 7 and 13 are patentable over the prior art of record and are in condition for allowance. The other claims in this application are each dependent from one of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, the applicants respectfully request favorable consideration and early passage to issue of the present application.

The applicants' undersigned attorney may be reached by telephone at (845) 894-6919. All correspondence should continue to be directed to the below listed address.

Respectfully submitted,

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